substance: boron compounds with group II elements
property: properties of beryllium-aluminum-boron compounds

There are numerous compounds of the approximate chemical compositions $Al_{\sim(1 \pm x)}Be_{\sim(1 \pm y)}B_{22}$ (x+y ~ 2) with α-AlB_{12} type structure. For details and references see $AlBeB_{22}$.

The compound $Al_{1.0}Be_{0.7}B_{22}$ [79H] and the compound $(Be,Al)B_{12}$ with the "believed" composition $Be_{0.1}Al_{0.9}B_{12}$ [79G] are subsumed here (see also [68B, 75B, 72K]).

Structure

The crystal structure is strongly related to that of α-AlB_{12}, but the metal distribution is different. The beryllium atoms are accommodated in the two types of truncated tetrahedral holes which are vacant in α-AlB_{12} [79H].

position and occupancy of the metal atoms
(data from [79H])

Atom	Position	Occupancy [%]	
		$Al_{1.0}Be_{0.7}B_{22}$	α-AlB_{12}
Al_1	8(b)	35.1(6)	71.7(7)
Al_2	8 (b)	29.1(7)	49.1(3)
Al_3	8(b)	38.7(7)	24.0(6)
Al_4	8(b)	0	15.0(3)
Al_5	8(b)	0	2.1(5)
Be_1	8(b)	46(3)	0
Be_2	4(a)	42(6)	0

space group: D_4^4 – $P4_12_12$ or D_4^8 – $P4_32_12$.

lattice parameters

a	10.180(2) Å	79H
c	14.257(2) Å	

Physical properties

energy gaps

E_g	2.12 eV	T = 300 K	optical absorption	79G
	2.1 eV	T ≥ 800 K	electrical conductivity (see Fig. 1)	

activation energies

E_A	0.7 eV	T = 300...500 K	electrical conductivity (see Fig. 1)	79G
	0.55 eV	T = 200...300 K		

trap density

n_t	$4 \cdot 10^{13}$ cm^{-3}	$I - U^2$ region	$I - U$ characteristic	79G

electrical conductivity: Fig. 1

***I-U* characteristic:** Fig. 2

lattice absorption spectrum: Fig. 3

dielectric constants

$\varepsilon(0)$	18	T = 300 K	improbable value (cp. comment to Fig. 3)	79G
$\varepsilon(\infty)$	8.3	T = 300 K	interferences, platelets d = 50...100 μm; λ = 2...9 μm	79G

References:

68B Becher, H. J., Neidhard, H.: Acta Crystallogr. B 24 (1968) 280.

72K Krogmann, K., Becher, J. H.: Z. Anorg. Allg. Chem. 392 (1972) 197.

75B Becker, H. J., Rethfeld, H., Mattes, R.: Z. Anorg. Allg. Chem. 414 (1975) 203.

79G Golikova, O. A., Kazanin, M. M., Orlov, V. M., Tkalenko, E. N., Fedorov, M. I.: J. Less-Common Met. 67 (1979) 363.

79H Higashi, I.: J. Less-Common Met. 67 (1979) 7.

Fig. 1.

$Be_{0.1}Al_{0.9}B_{12}$. Conductivity vs. reciprocal temperature [79G].

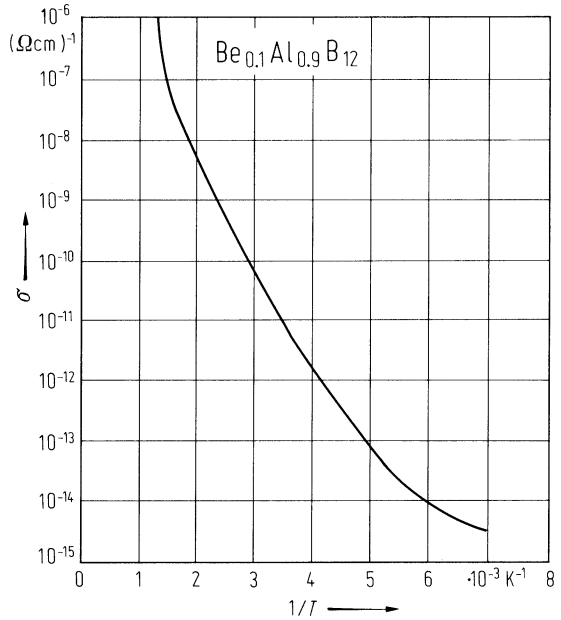

Fig. 2.

$Be_{0.1}Al_{0.9}B_{12}$. Current-voltage characteristics at various temperatures. Curve *1*: *T* = 113 K; curve *2*: *T* = 145 K; curve *3*: *T* = 185 K; curve *4*: *T* = 232 K; curve *5*: *T* = 293 K [79G].

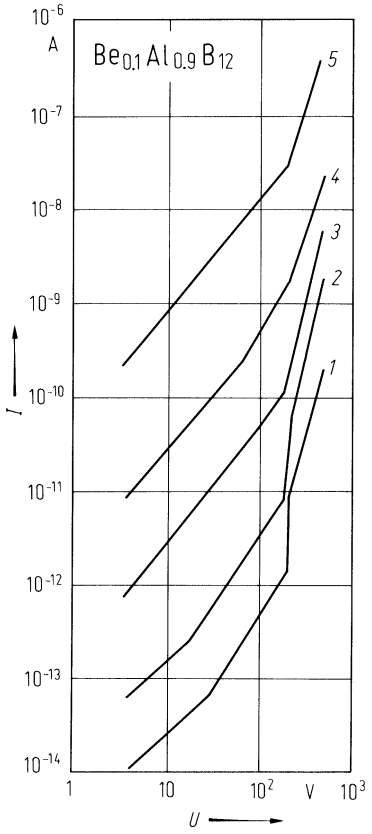

Fig. 3.

$Be_{0.1}A1_{0.9}B_{12}$. Absorption coefficient *K* and reflectivity *R* vs. wavelength. (Remark: the strong increase of the reflectivity with increasing wavelength cannot be explained by lattice vibrations of such low oscillator strengths. Hence $\varepsilon(0)$, which has been derived from *R* should be put in question, too.) [79G].